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Introducing Structured Methods: An Undelivered Promise? — A Case Study

Karlheinz Kautz
Norwegian Computing Center, karlheinz.kautz@rmit.edu.au

Tom McMaster
University of Salford, T.McMaster@mcs.salford.ac.uk

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Karlheinz Kautz

Norwegian Computing Center
P.O. Box 114 Blindern, N-0314 Oslo, Norway
Karl.Kautz@nr.no

Tom McMaster

Department of Mathematics and Computer Science at University of Salford
Salford, M5 4WT, England
T.McMaster@mcs.salford.ac.uk

Abstract

Structured methods for the development of computer-based systems have been promoted for more than 20 years. This paper takes its starting point in the question why structured methods are still not in wide spread use. We focus on the role the introduction process of a method and its context in an organisation plays for this problem and present an empirical case study of an attempt to take a structured method into use in the IT Unit of a U.K. public sector organisation. A framework consisting of interdependent key factors is used to structure the presentation of the case. Based on the analysis of the interplay of these factors, recommendations for the improvement of method introduction are given. Some of these recommendations have a more general character, and some are directed in particular towards the organisation under consideration. They do not offer a guaranteed prescription for success, but we feel that they have some value in that they may help to promote the further diffusion of structured development methods.

Keywords: *structured methods, introduction and diffusion of software devlopment methods, organisational and social aspects of system development.*

1. Introduction

Structured methods for the analysis and design of computer-based systems have now been promoted for more than 20 years. They consist by and large of a mixture of guidelines, techniques and representational formalisms for the approach to, and structured completion of system development activities. Many of the organisations which deal with the design and construction of computer-based systems, apply structured system development methods with varying degrees of success and there are still a great many system developers who do not use structured methods at all, though some of these have attempted to introduce methods into their work practices. Where some organisations may have found increased benefits from the adoption of such methods, others have met only with dismay and failure.

This paper takes its starting point in the question why structured methods are still not in wide spread use. We are interested in the role the introduction process of a method into an organisation plays in this context. This view goes beyond looking at the mere features of a method and their use in a lab as well as in a commercial environment, but naturally covers the initial use of a method by the system developers in an organisation.

The paper presents an empirical case study of an attempt to take a structured method into use in the IT Unit of a U.K. public sector organisation. The investigation builds largely up on interviews conducted with the stakeholders involved in the introduction process. A framework consisting of interdependent key factors is used to structure the presentation of the case. Based on the analysis of the interplay of these factors, recommendations for the improvement of method introduction processes are given. Some of these recommendations have a more general character, and some are directed in particular towards the organisation under consideration. They do not offer a guaranteed prescription for success, but nevertheless we feel that they have some value in that they may support future introduction processes of system development methods.

The paper is structured as follows: Section 2 introduces the background and related work of the study. Section 3 explains the research framework which is based on research into the introduction of information systems. Section 4 gives a critical appraisal of the research approach chosen; both aspects of case studies and interviews as techniques to collect data are discussed. Section 5 then contains the case itself, the attempt to introduce a structured method into the IT Unit of a U.K. public sector organisation. Section 6 comprises the discussion of the case and the presentation of the recommendations. Section 7 finally contains some conclusions summarizing the results of the investigation.

2. Background and related work

In an article published in Datamation, Yourdon (1986) states that approximately 90% of the world-wide professional data processing community is at least superficially familiar with the basic concepts of structured methods. He continues, however, that only 10% of the dp-organisations in North America practice structured techniques in a disciplined way. He gives three main reasons for

this, all of them rather technical: (1) people get frustrated with the amount of manual labour required to develop structured analysis models; (2) people get frustrated with their inability to apply structured analysis to complex, real time systems; and (3) people are lured away from structured analysis by the promises of prototyping tools and fourth generation languages.

Floyd (1986), on the background of an experimental lab evaluation, presents two further problems of structured methods as (1) being based on a linear worldview of the system development process; and (2) providing only inadequate techniques for datamodelling and for the design of man-machine interfaces. Smolander *et al.* (1990) in a Finish study on the use of methods in system development organisations confirm these results. Bansler and Bødker (1993) explain how structured methods are actually used in contrast to how they are portrayed in the normative technical literature on the basis of an exploratory case study in Denmark.

Humphrey (1989) like Yourdon (1986) reports low numbers concerning development organisations in North America using structured approaches to system development. His explanation is that most organisations simply are not mature enough to use structured methods.They first have to establish an orderly framework for their development processes including especially project management mechanisms. Raghavn and Chand (1989) use innovation theory as introduced by Tornatzky and Klein (1982) and Rogers (1983) to investigate the diffusion of methods. Applying five key innovation characteristics; relative advantage, complexity, compatibility, ability to be tried out, and visibility, they explain that practitioners experience several problems with methods. In addition, they show the wide gap between how method developers perceive methods and how possible users perceive them. They conclude that methods are either oversold or poorly communicated—or both.

Several authors look at the introduction of methods in the context of organisations. Zmud (1983, 1984) views the introduction of modern software practices as an organisational process innovation and states that such process innovations seem to be scarcely adopted. Andersen *et al.* (1986) discuss strategies for changing working practices in general in development organisations and Iivari (1987) interprets methods for the development of information systems as an organisational change. Veryard (1987) stresses the importance of planning activities when implementing a methodology as a major organisational change. His advice is that established principles of change management should be applied.

All this work presents important factors for the understanding of the success of structured methods and implicitly refers to the crucial role the introduction process of a method plays in this context. Our interest is explicitly directed towards these introduction processes.

3. Research framework: using research into the introduction of information systems

Veryard in the above-mentioned work (Veryard 1987) argues also that a methodology can be viewed as an information system as it involves the creation, com-

munication, and interpretation of information and decisions, as models and specifications. This is in line with general definitions of information systems, as for example the one given by Avison and Wood-Harper (1990) who define an information system as a "system to collect, process, store, transmit, and display information". This view of methods looks appealing to us and we will apply it for the construction of our research framework expecting that knowledge from this field will be a valuable source for understanding attempts to introduce structured methods for system development.

Success factors and problems related to the introduction and implementation of information systems into various application domains have been extensively studied and documented. Roberts and Barrar (1992) identify the following seven key factors for the successful implementation of information systems; (1) antecedents to the introduction, (2) management support and commitment, (3) project mission, (4) organisational culture, (5) method useability and validity, (6) education and training, (7) monitoring and evaluation. These are based on a study of the introduction of manufacturing resource planning systems. In literature surveys and case studies, Lyytinen and Hirschheim (1987) and Hirschheim and Newman(1988) present similar results. They stress in addition the role of the involvement in the change of those directly affected by it.

Wastell (1992) has however rightly criticised simple factor analysis. Developing, introducing and using information systems are complex social phenomena which cannot easily be grasped and which cannot be understood and expressed as a number of static and mechanical laws. Every introduction process and every organisation is unique. Like Wastell, several other authors (see, f. ex., Markus (1983), Hirschheim *et al.* (1987), Bjerknes (1992), Walsham (1993), Kautz and Kluge (1994)) argue that there exists a causal logic, but not of simple lines, but of an interaction or dialectics of different factors. We claim that this is also valid for the introduction of structured methods into development organisations.

We will apply the key factors as described by Roberts and Barrar (1992) and Hirschheim and Newman (1988) for our investigation into the introduction of system development methods, and adapt them for our own purpose. We will however use them mainly to structure the presentation of our case study. It is important to keep in mind that it is the interplay between these factors which makes the whole picture. We will come back to this point in the discussion of the case. In short, the factors can be explained as follows:

Antecedents to the introduction
This factor refers to the history of an organisation prior to the introduction of a system development method, focusing on those events which seem likely to affect the introduction process. Points of interest here are the organisation's position in the marketplace and its clients' views of its credibility. This also concerns any earlier attempts to introduce methods and tools.

Management support and commitment
Proper planning and supervision of the introduction process are essential management duties. This will include ensuring that staffing levels are appropriate,

and that there is provision for sufficient additional resources to facilitate a successful outcome. The level of encouragement and support for staff during the difficult period of transition, seems to have a crucial bearing on the success or otherwise of the adoption of new technology and practices.

Project mission
This relates to the aims and objectives of the introduction process. It is important that the purpose and goals of introducing new methods are explicitly and very clearly spelled out to all of those concerned. This should go beyond expressing platitudes, general statements and mere technical descriptions. A clearly expressed and communicated mission statement means that the 'vision' can be shared.

Organisational culture
This factor refers to the values, beliefs and norms in all parts of an organisation affected by the introduction of a method. It concerns attitudes towards the way in which work is organised and carried out. It also includes the relationship between different groups involved. This is not only valid for the developers, but also for their clients' departments.

Method useability and validity
This factors concerns technical aspects of a method, and raises questions such as: Is it easy or cumbersome to apply? Is it valid for the organisation? Does it fit into the work practices and patterns of the developers? What efforts are required to make it fit these patterns? Is it is suitable for the purposes for which it was intended?

Education and training
Initial and on-going training has been found to be a prerequisite for the successful introduction of a method. Therefore it is a matter of some importance what kind and quality of education the future users of the method received prior to its implementation in a live project. The extent to which on-the-job advice and assistance, as well as what follow-up training and support are provided, is also a matter of concern.

Monitoring and evaluation
Monitoring and continuous evaluation of both organisational and technical aspects of the introduction process are essential, as they enable revisions to the chosen strategy to be made, where necessary. The focus of interest here is how monitoring and evaluation of the effects of the method are carried out during its actual use.

Involvement in change
Involvement in a change process is thought to produce commitment to, and knowledge about the change. By exploiting the expertise of all groups involved, the quality of change can be greatly enhanced. Participation is also a means to safe-guard different interests. What is of some concern therefore, is how far employees are involved in the decision process to introduce change, i.e. in the choice of a particular method, and to what extent they have participated in a possible adjustment of the method to meet their work practices.

4. Research approach: case studies and interviews

Galliers and Land (1987), in a taxonomy of information systems research approaches have identified five main objects of study. These are; society, organisation/group, individuals, technology, and methodology. They also identify a variety of modes of research, which fall broadly between traditional empirical approaches, and newer interpretive approaches. Our focus is on the organization as the object of study for our investigation, using a retrospective case study as the vehicle for our approach, and the mode is largely of a descriptive and interpretive nature. Since we are concerned with theory-building in a broader sense, case studies are, according to Zmud *et al.* (1989), highly appropriate, in that they offer a holistic view of the processes involved (Gummesson 1988) as well as a high level of richness of worldly realism (Mason 1989).

There are however disadvantages, in that with such an approach there is a predisposition to weak internal and external validity (Zmud *et al.* 1989), or as Mason (1989) puts it, a lack of control and a corresponding difficulty in generalizing the results. Knowledge gained through case studies might not be formally generalizable, but this does not mean that it does not contribute to the collective body of knowledge of a discipline (Flyvbjerg 1992). Any research approach is inevitably a trade-off between tightness of control and richness of worldly realism. We have chosen the latter, because whilst we may be compromising our ability to generalize, we nevertheless feel that we are also more able to offer valuable insights to the specific organization under discussion.

The fact that our case study is an historical analysis, also has advantages and disadvantages. One disadvantage, it might be argued, is that memories might be somewhat lacking, and that accounts of the processes being investigated may as a result be factually flawed. From our point of view this is not a matter of any great concern however; for one thing, it is improbable that all of the respondents could forget the same critical piece of information which would substantially bias the study, but also, perhaps more importantly, we are not concerned with simply trying to recount facts, but rather to investigate the processes of introducing the structured method into the organization, through an interpretation of the feelings and accounts of those who were directly or indirectly involved. Some advantages of historical analyses described by Gummesson (1988) include helping to awaken the study object from "organizational slumber", helping to raise company morale where this may be low, creating new knowledge, breaking vicious circles, and building a "hermeneutic bridge", that is, viewing history as a means of interpreting both the present and the future of the organization.

The study employed qualitative research techniques such as unstructured and semi-structured interviews, and document reviews. It was executed over a period of 4 months and included 12 interviews, each conducted by two researchers and each lasting between 45 and 90 minutes. Each researcher kept their own records of the interviews, and by cross-referencing these, interview records were produced which were subsequently endorsed by the respondents. One of the

researchers had an inside view of the organisation, and on this knowledge staff were approached on the basis of their willingness to cooperate. Participation in the study was voluntary and no restrictions from management were imposed. All of those involved in the first project using the method were interviewed, with the exception of the System Development Manager who had left the organisation. Other staff at team leader level who had participated in the training programme were included in the study, and a representative of the customer department which was to use a product to be developed using the structured method, provided material from the client perspective. The interviews were not tape-recorded as the presence of a recorder might have inhibited responses taking into account the nature of the topic and the organisation under investigation.

Interviews are verbal reports and as such subject to problems of interview bias, poor memory, and inaccurate statements (Nachmias and Nachmias 1981). Kidder (1981) argues however that many critics tend to exaggerate the significance of interview bias. They overlook the fact that scientists interested in social and organisational issues are dependent upon data which have been collected by means of oral or written reports. The reports are, no matter how collected, invariably subject to essentially the same errors and bias than those based on observations, experiments, or survey questionnaires as used in other disciplines. The main difference is that scientists concerned with social and organisational studies, as they depend largely on interview reports, usually are more aware of the dangers and difficulties involved.

One must nevertheless be aware of the fact that interview subjects have a tendency to retrospectively rationalizing their behaviour and acts. We have therefore substantiated our interview material with document studies. A number of documents were reviewed including two professionally conducted surveys which were commissioned by the organisation under investigation in 1989, to analyse and improve the working practices of its IT Unit. These surveys were undertaken by external consultants from an organisation of national repute. One contained views of the IT Unit seen through the eyes of its departmental clients. The other one described the IT Unit in terms of hardware capacity and application software, as well as staff, strategic issues and management structures. This one was performed by an external consultant who in addition was brought in to manage the IT Unit for an interim period. Other documents included internal memoranda and a draft of a speech given by the System Development Manager to departmental representatives outlining the expected benefits of method to be introduced.

Finally, it might be argued that looking at the introduction of structured methods without relating it to supporting software tools does only make sense to a limited degree. In the organisation under consideration however the general thrust for the introduction process was the method and not a software tool. We also agree with Humphrey (1989) who postulates that if an organisation has not already established a common working framework, with other words, a method for the system development, the installation of a CASE system can be traumatic.

We will therefore focus on the introduction of a structured method only.

5. The IT Unit Case Study

The subject of the case study is the Information Technology (IT) Unit of a public-service organisation in the U.K. The whole organisation consists of 17 major departments which are controlled via a number of committees. Each department is headed by a Chief Officer. The IT Unit is one of six sub-units of one of these departments. The IT Unit itself consists of two main divisions, roughly divided between development and operations activities. Like all other units it is headed by a Unit Manager. The Unit exists to provide IT services to the 17 departments, and whilst it traditionally trades internally on a not-for-profit basis, recent government legislation means that it has to prepare itself for a compulsory competitive tendering environment.

The structure of the wider organisation is of an extremely hierarchical and bureaucratic nature, and typical of many local authorities. This is reflected in the structure of the IT Unit itself. The Unit employs around 130 staff, with about 50 of these in the development division. This is the part of the Unit we are concerned with. It is headed by the Systems Development Manager.

There are around 120 systems running on the Unit's mainframe computer, and these may be broadly divided into three main areas; Financial systems, Land and Property systems, and miscellaneous Departmental systems. Many of these have been developed in-house, and/or are supported and maintained by one or more of 10 development teams which are organised around the respective application areas. Three Senior Business Analysts are responsible for these broad systems areas. Together with the Systems Development Manager, the Senior Business Analysts form the Business Systems Management Team. Another group, the IT Unit Management Team, is made up of the IT Unit Manager, the Business Systems Management Group and the Operations Management Team.

The development teams themselves consist of a Team Leader, one or more Senior Programmers and one or more 'Junior' Programmers. The Team Leader is often a system analyst. This person is the link between the client department and the IT Unit, and is responsible for designing, generally in co-operation with the respective senior programmers, program solutions.

In 1988 the IT Unit purchased SSADM, the Structured Systems Analysis and Design Methodology (Downs *et al.* 1988) in form of a compact training course together with the accompanying documentation. The method is a quasi-official U.K. government approved standard which is used in many public service organisations.

Prior to the training, a housing project, had been chosen to deploy SSADM immediately. Following the course this was a major project and it was not long before difficulties were encountered. The situation deteriorated as project deadlines could not be kept. The cessation of all practices related to SSADM was the response ordered by the Systems Development Manager. The introduction of the structured method clearly failed, but what were the reasons for this failure and (how) could this fail-

ure be prevented? To find answers to these questions, the case will in the following be presented in more detail using the key factors as described earlier.

5.1. Antecedents of the introduction

The study of the historical context of the method introduction showed that morale within the development division of the Unit was low. A report stated that many of the systems were over-large, unreliable, inflexible, outdated and very difficult to change. On another front, the compulsory competitive tendering scheme which the government had begun to introduce into district councils, offered little in the way of assuring future job security, a condition which employees of local authorities have traditionally enjoyed. On the contrary, it posed a threat for which the Unit staff, with little or no experience in commercial business practices, were at the time ill-prepared.

Another factor, the credibility of the development staff in the eyes of their clients, was generally poor. There were a number of factors contributing to this. Most departments expressed frustration with the development division, their impressions were that other departments were receiving substantial resources from the section, and none felt that it was theirs which was reaping the benefits. As a result, many departments ignored the section. They no longer requested advice or assistance, because they felt that requests for resources might take years to surface. The developers were seen not as a source of informed expert opinion on IT matters, but as a barrier to the successful exploitation of IT services.

Further criticisms suggested that the development teams usually completed only the first phase of a project, after which resources were often withdrawn, and before the system had sufficient functionality to produce worthwhile benefits. The staff lacked the motivation to complete an application and to seek new work. There was a lack of direction, partly due to a prescriptive 'do as you're told' style of management, and relations between development and operations were strained as the report states, probably due to antagonisms displayed between two former senior members of staff.

Finally, an attempt had been made one year earlier to introduce a fourth generation language tool, and this had remained largely neglected and unused, despite comprehensive training for all development staff. This has since been abandoned following the expiration of the license agreement with the suppliers.

5.2. Project mission

The System Development Manager, in a presentation to the senior staff of client departments, offered a detailed justification for the introduction of SSADM. The stated benefits included a reduction in development costs, a reduction in the resources necessary for development projects, and improvements in quality and project control.

She also declared that faster and more accurate program specifications would be achieved, and the method would provide visible development stages with identified deliverables, produce documentation that is fully accessible to all parties concerned with the project, and which would assist in the monitoring of performance levels. The method would additionally provide communication techniques between the developers

and users which would be clear and unambiguous, facilitating distinct requirements definitions and agreements with the users through all stages of the process.

For the staff of the development section however, these goals were not at all evident. Questioned on whether they knew why the method was introduced, some said that they had no idea, while others assumed that the method was introduced to support project control, and as a means of measuring progress. Improved documentation was also mentioned. Another possible aim was expressed; the method might have been introduced as a means to control the users, in the sense that it would provide the developers with contracts that have been signed-off, and these could then be used as a firm basis for additional and further development activity. There was also an assumption that SSADM was employed in the housing project precisely for this reason. This project had been under way for about a year, and was already seriously behind schedule, because the users would not agree on a requirements document.

It has also been stated that the method might have been purchased simply because many other government bodies use it, and that this would bring the authority into line with 'convention'.

As far as IT Unit staff are concerned, there was no clearly identifiable mission, and this is reflected in the variety of assumptions expressed regarding the aims and objectives of the exercise.

5.3. Management support and commitment

Apart from the provision of the training courses, there was little if any management support. Staff felt that there was a lack of planning and no overall strategy behind the introduction of the method. There is no evidence that the use of SSADM was encouraged in any project other than the housing one.

For the housing project itself, a new senior programmer with experience in using a structured method, though not specifically SSADM, was employed. There were no additional resources allocated to the project however, such as new time schedules which would take into account the fact that team members needed to consolidate what they had learned in the classroom, with its practical application, and their lack of experience in producing and understanding the complex diagrammatic documentation produced by the tool.

The result was that the project ended up following the method line-by-line, so to speak. There are suggestions that this approach was constantly forced upon the development staff by directives from the System Development Manager, but contradictory statements have been made about this point. However it came about, this was nevertheless the approach applied to the project.

In addition, the development staff lacked easily accessible guidance and advice, for which they had a frequent need. They also wished they had had more encouragement and freedom to employ the method in a way which they considered to be appropriate to their own styles, and to the requirements of the project. What they experienced however, was even more pressure through the fact that management wanted to control and approve all products which, according to the method description, had to be produced. This impression was reinforced

by day-to-day directives from management, which was often a reaction to complaints from the client department who were frustrated at the seeming lack of progress.

5.4. Organisational culture

The atmosphere in the development section at the time of the introduction of SSADM, was stamped by the somewhat autocratic style of management employed by the System Development Manager, who, while not directly involved with daily analysis and design activities, nevertheless signed all contracts with user departments.

The relationship between management and development team staff was rather tense. Team Leaders did not feel included in managerial decisions, and as far as staff were concerned, management roles were not entirely clear. The relationships between development and operations sections were reported to be poor, and internal communications, both vertically as well as horizontally across the hierarchical structure, was a source of much criticism.

Management and staff by and large, lack experience outside of the organisation. A policy of internal promotion has traditionally been pursued, and this has led to a certain amount of 'in-breeding'. Trainees were recruited, trained and subsequently promoted within the Unit. Thus, a culture was perpetuated in which initiative was rarely encouraged, and this in turn has led to the prevalence of a certain kind of conservatism within the Unit.

For example, although all but two respondents said that they would be prepared to give SSADM another try, providing that a coherent strategy was put into place and that adequate resources were provided, they would all nevertheless reject its use in their current projects. They argue that their projects are unsuitable for such a complex and time-consuming method, as they mainly deal with enhancements and maintenance to existing systems, and their tasks have to be performed within strict time constraints.

This tendency to conservatism is further underlined by the fact that an internal project which aimed to change the developers work practice in terms of time-recording, also failed because the developers were not willing to provide the information necessary for it to succeed.

5.5. Method useability and validity

The work practice in the development section can be characterized as having been rather informal. Some teams used bits of structured methods, but in general described their work style as intuitive and unstructured. No overall approach to system development was commonly followed by the teams. In some teams, little if any documentation was produced, while in others specifications were written in prose English. These were often supplemented by data flow graphs and diagrams. The Team Leaders on the whole however, had considerable knowledge about their application domains, had direct contact with their clients, and enjoyed a high degree of autonomy in their daily routines.

Maintenance and small enhancement to systems did not require approval from higher authority in the Unit, but if these were substantial, then for contractual purposes, approval to carry out the work was required. This was interpreted very loosely by the various Team Leaders,

and no definition of 'substantial' seemed to exist, although a Senior Business Analyst reported that anything requiring more than 3 days work must be notified, and approval obtained. Often, users would call the project team by telephone for small enhancements to a system, or for some routine maintenance work. This may or may not be carried out immediately, depending on who took the call and the level of priority assigned to the task, though it is not entirely clear who made the decision, or how they were made. If the work was expected to take more than one day, a form was supposed to be completed, though this did not always happen. There seemed to be no criteria for distinguishing between enhancements and maintenance work.

Although this work practice had been successful in some projects, especially when quick changes were demanded, it also included some drawbacks where more complex changes or larger development tasks were concerned. The management would not necessarily know what work was currently in hand, and they had little control over its prioritisation. For them this was a problem. Another problem related to the lack of control, was that a relatively junior programmer could carry out some work on a system which he or she had little experience with, release a module which then, and this had happened, caused a breakdown of the system. The programmer responsible for this could easily be unavailable, either on holiday, or off sick.

In the housing project with the introduction of SSADM, the work practice was changed dramatically. The developers had to follow a prescribed way which they felt was inappropriate and "too long-winded". They had to deliver every intermediate product to the management for approval even before it had been discussed with the users, in an environment where requirements were frequently changing. Nevertheless, under time pressure they often would continue working using results which were not officially approved. They had to use SSADM even although, on the basis of their knowledge of the application area, they thought that they already knew what requirements needed to be specified, and what solution they would propose. All they needed was a binding contract from the users. Applying SSADM forced them into many, what they believed were, unnecessary discussions with the users so that they could document the results with the method. This procedure frustrated the users who thought they had given the necessary information already and who were waiting for results.

The developers felt there was a lack of commitment from the client department, which they considered crucial for working with such a method. The representatives from the client department changed 3 times during the project, and at one stage they included one person who was opposed to computerisation, and another who, because he was new to the department, had far less knowledge about the application area than the developers.

Finally, from the developers' perspective, their own management as well as the user department's representatives, had seriously underestimated the effort required by all sides to cooperate in a development project, if it is to succeed.

5.6. Education and training

Several training courses were purchased to introduce SSADM into the organisa-

tion. IT Unit management and senior representatives of the user departments were given a one day overview of the method. One Senior Business Analyst said that it was difficult to understand the method in any detail from this presentation. According to him little knowledge could be obtained concerning the different diagrammatic techniques. During the housing project this course formed the basis for his responsibility in chairing quality assurance meetings. He stated that he had difficulties in understanding the diagrams presented to him during these meetings, despite his many years experience in system development.

The Team Leaders and Senior Programmers were trained in two different groups, each course lasting 9 days. It was the first course in system analysis in over 15 years held for development staff in the organisation. Most interviewees judged the course to have been of a high quality, where they learned a good deal in a comparatively short space of time. Some stated, however, that the course was not simple and assessed the method as complex and demanding. They expected a difficult learning period during its application, where immediate results would not be easily achieved. Different opinions existed as to whether or not advice and guidance for adjusting the method was given. At the end of the course, most participants had the impression that the method was very long-winded and time-consuming when applied step by step.

Developers on the housing project therefore had doubts about the suitability of the method for this project. They also felt that they were not well equipped to perform a major project on their own. As a result, they frequently had to consult the trainer by telephone on an informal basis, as there was no provision for on-the-job support or follow-up training. At the same time, they were having to provide the user department's representatives with extensive explanations about the documents which were being produced, and to try to persuade them to sign these off. This rarely occurred as the users felt that they were unable to understand the documents sufficiently enough to commit the department to binding contractual agreements.

5.7. Monitoring and evaluation

No systematic monitoring of the use and effect of the method was reported from the housing project. The documents produced by using the method were checked by management and assessed in regular quality assurance meetings. These were attended by the developers and users under the leadership of a Senior Business Analyst.

In these meetings the developers' work was often discussed, but there were few tangible results. Often the same ground had to be covered again and again, and this led finally to a judgement that the method would not bring the benefits originally expected. The Team Leader and the Senior Business Analyst agreed that the method as it was being applied was too time-consuming and ineffective. After a period a little over a year following the introduction of the method, they recommended that in the interests of economy and to salvage whatever credibility in the Unit was left, the use of the method should stop. This recommendation was accepted by the System Development Manager who ordered that all use of SSADM should cease forthwith. Until this study, no post-

mortem into the reasons for the failure, or any formal assessment of the method had been conducted, and the whole episode was 'forgotten'.

5.8. Involvement in change

The System Development Manager used to make all substantial decisions on her own. The introduction of SSADM was no exception to this behaviour. No one participated in the decisions concerning the practices related to the employment of SSADM. Neither the Senior Business Analysts, nor the Senior Programmers were asked for input when the decision was made to implement a structured method at all. No staff were involved in the process of selecting SSADM as the particular method to be introduced, and no one participated in the decision to employ SSADM on the housing project.

The development team working on the housing project was the only team to receive a directive to apply the method. Thus no other team acquired expertise in its practical use, which otherwise might have proved useful for comparing and evaluating the effectiveness of SSADM.

In general, staff tended to wait to be told what to do next. Mechanisms for suggesting changes in working practices did not exist, even in those areas where staff had particular expertise. During the housing project for example, the Team Leader developed some ideas about how the method might be adjusted to suit the project, but this was not communicated to her superiors.

6. Discussion

The various factors which we have used to examine the organisation under discussion, have provided us with a useful set of tools for such analyses. However, at the outset we recognise that these are merely artificial constructs. They are not mutual exclusive and its their interdependency which is particularly revealing. With this in mind, we can say that the IT Unit's difficulty with the introduction and use of a structured method, is reflected in the somewhat negative factorial views reported here.

In advance of the introduction of the method, the development section had been beset by problems. For example, the staff had to deal with low quality systems, and their clients were far from content with the services being delivered. In addition, a prior attempt to introduce a fourth generation language tool had failed. Such an environment, as also Roberts and Barrar (1992) and Walsham (1993) report, does not provide the most suitable setting for implementing change.

The history of the IT Unit with respect to introducing change, is not marked by great success. However, the Unit staff have some considerable strengths, and it is upon these that they must build. For example, they know their customers very well indeed, and this is an enviable quality, as any commercial organisation would admit. They need to find new ways of looking at their history, which takes these strengths into account. This might take the form of a redefinition of their contractual relationship to their customers.

Referring to the project mission and seeing it with regard to the culture and management style predominate in the IT Unit, we can state that there were a number of overt goals to be achieved through the introduction of the method,

and these have been described earlier. It is unfortunate that these were not communicated clearly to the development staff. Neither were the staff involved in their formulation. Research into the problems of introducing information systems confirms (see Lyytinen and Hirschheim (1987), Hirschheim and Newman (1988), Roberts and Barrar (1992)) that such a situation can jeopardize the success of a change process. Our advice for the IT Unit would be: With the participation of all interested parties, (1) compile a list of clearly defined objectives, (2) compose a mission statement which embodies these, (3) communicate this to all staff and clients concerned. Ownership is a key concept here, and through participation and communication this can be achieved.

As far as management support is concerned, there seems to have been no analysis or planning for the introduction of the method in anything other than a superficial way, i.e. fixing dates for courses. Management was acting under strong pressure, but this does not justify all the omissions. There was no real and positive encouragement and support for using the method, although it is true that a kind of coercion took place. No pilot project for testing the effect of a major change was selected. Instead, the members of an important project had to perform their work using the method.

We might speculate that failure was inevitable, because the conditions were ripe for resistance to have developed, although this was not the de facto reason for the method's failure.We would make the following recommendations; (1) analyse the need for change carefully, and determine what methods are available to meet the need, (2) organise an agreed strategy for the introduction of the method, (3) select one or more appropriate pilot projects, (4) provide sufficient additional resources in terms of staff and time, (5) encourage staff to use the method, (6) develop, agree and implement evaluation procedures.

Looking at education and training, we again find a number of deficiencies in the IT Unit. Staff were trained and then, with their comparative inexperience, were expected to undertake an ambitious project without any formal on-the-job support. It is hardly surprising that the development method failed. We take the view that management, as well as development staff should be adequately trained if they are to make decisions and sign contracts on the basis of documentation produced by the method. Furthermore, if users are to cooperate successfully with development staff, they too require adequate training.

It is one thing to give advice, but quite another to implement that advice. This is particularly true in an organisation where autocratic management styles are the norm, where staff are excluded from decision-making processes, where initiative is not encouraged and where there is a defensive, insecure and tense relationship between the staff and management. It would be difficult to translate the recommendations into actions without first of all fixing the social and organisational problems which exist. A change of culture and working practices is required, even if this means exchanging some of the personnel.

These recommendations are although directed towards our specific case rather general. Looking at the role of further organisational issues where the validity of the method is concerned leads to more

case specific recommendations. With regard to the application area for example, SSADM expects and requires a degree of formality in procedures applied to the transformation and modelling of data, and for the identification of different functions and user roles (Eva 1992). In addition, SSADM activities are centered on a stable data model. These prerequisites were only partially met in the client department which was analysed using the method. Here changing requirements for one reason or another were more the rule than the exception. Other approaches that try to deal with these uncertainties, such as Soft System Methodology (Checkland 1981) or Multiview (Avison and Wood-Harper 1990) might provide a more appropriate means for a pre-study, creating a foundation for a structured method.

Eva (1992) also requires an environment in which there is complete cooperation between the developers and their clients when applying SSADM. The relationship between the IT Unit and its clients in general was not very formal. This might be partly due to developers willingness to do work for their clients without formal contracts. In the housing project the client department showed little commitment to the project. The method delivered results described in a formalism, but it did not itself create a more formal and committed working relationship between the developers and users. The developers need to consider their approach to their clients, and the clients have to recognize their own responsibilities, and cultivate an attitude which is conducive to, and necessary for fruitful cooperation.

Another critical issue is the useability of formal documents. Although there is little doubt that structured, formal specifications can be successfully applied by system developers, there is evidence that formal specifications are unsuitable for communications between developers and users (Gomaa and Scott, (1981). Using such documents as an exclusive basis for contracts between the business partners, might therefore be a futile venture. Structured methods can be combined with more tangible approaches such as prototyping (Gryzcan and Kautz 1990, Budde *et al.* (1992) , and this again is not a technical issue, but an organisational one. Before employing any approach which is based on cooperation, an organisational environment has to be created prior to the project proper, in which cooperation can take place.

Let us finally turn our attention to the work practices within the IT Unit. The prevailing style in the development section had been informal, largely intuitive, and the Team Leaders were for the most part self-governing. With the introduction of the method a high degree of discipline and control was imposed upon the developers who had to deliver every document for approval. This, however, did not lead to the desired discipline as the developers often continued working without approved results. Control was tied to the manner in which the method was applied.

The developers had to follow a strictly prescribed technique step-by-step. Andersen *et al.* (1986) state that strict adherence does not fit the work practice of system developers and Gryczan and Kautz (1989) argue that strict observance of predefined rules is counterproductive. Smolander *et al.* (1990), Stolterman (1992) as well as Bansler and Bødker (1993) report in empirical studies that

many skilled developers use only parts of a method, and that they judge methods which show a simple and consistent picture of the development process as irrational. This is in line with the feelings of the developers in the housing project. They felt restricted by the method, particularly by the way in which it was used, and they assessed it to be both inappropriate and impractical. One possibility for overcoming this problem, is to tailor the method to the specific needs of the organisation. This might lead to the right balance between structure and control on one hand, and informality and autonomy on the other. In the context of SSADM, this has been proposed by Ashworth and Goodland (1990) in their textbook for the method. This is however not a technical matter as most methods can be easily adjusted by experienced developers themselves, but is an organisational and cultural issue, as it presupposes an environment in which tailoring taking into account all expertise existing in an organisation is wanted and possible.

7. Conclusions

Our case study describes an attempt to introduce a structured method and is an example for bringing about organisational change in a system development department. In this case the introduction of the method became an u delivered promise. The effects expected did not come and the method was abandoned. But this cannot just be explained by deficiencies of the method. The whole introduction process and its social and organisational context played a major role.

As a summary and to wrap up this paper, we like to put forward three main conclusions.

Research on the diffusion of structured methods consist by and large of quantitative studies or investigations which emphasise the use and the useability of method features. Such studies provide information about the spreading of different approaches and explain strengths and weaknesses of methods. We have broadened that view and focus on the introduction process and its context. Our case study shows that such a perspective uncovers additional facts and contributes to a better understanding of why or why not structured methods are spread and used.

We conducted our study based on the insight that the interaction of several, non-technical factors, and not the individual factors as such and independently from each other, influence the introduction process. This research perspective originated from work done in the field of investigating the development, introduction, and use of information systems. The work presented here demonstrates that such a framework can beneficially be transferred to research about the diffusion and use of system development methods.

Finally, on this basis, it is possible to give recommendations to support the introduction of methods for the development of computer-based systems. We have directed our recommendations to the organisation in our case study. Some of them are generalizable, some of them are not. They do not offer a guaranteed prescription for success, but we feel that they have some value in that they may help to minimise the risk of failure for

future introduction and further diffusion of structured development methods.

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